Amendments to the Specification

Please replace paragraph [0003] with the following amended paragraph:

[0003]   During the use of microcrystalline sinter abrasive grains, it can be observed in many applications that during the grinding process the abrasive grain, with comparable hardness and density, behaves the more favorably the more delicately the structure is developed. Particularly fine structures may be obtained via sol/gel processes in which e.g. super-finely dispersed aluminum oxide monohydrate of the Boehmite type is used as a base material which – after having been dissolved as a colloid – is processed into a gel which is then further processed into a compact and dense α Al_2O_3 sinter body via a drying, calcination and sintering phase. Subsequently, it is processed into an abrasive grain. The advantage of the ~~so/gel~~ sol/gel method for the production of corundums with microcrystalline structure lies in the fact that reactive base materials with very small components are used and the resulting green bodies can be condensed at relatively low sintering temperatures which favors the formation of a fine structure.

Please replace paragraph [0006] with the following amended paragraph:

[0006]   If one wishes to obtain a structure of the finest possible crystals, one can also use, in addition to the use of crystallization seeds, sintering additives that hinder the growth of crystals or accelerate the sintering process and thereby indirectly restrict the formation of larger crystals. The influence of individual additives to the sintering process and the crystal growth during the sintering of Al_2O_3 is summarized in the *"Journal of the American Ceramic Society Vol. 39, No. 10, 1956"*. Of the numerous patents that describe the use ~~off~~ of sintering additives or combinations of sintering additives and crystallization seeds for the production of abrasive grains via the sol/gel route, only a few examples will be described in the following. EP-B-0 024 099 describes the addition of spinels or, respectively, of raw materials that are turned into spinels during the course of the production process. EP-B-0 024 099 describes the use of α Fe_2O_3 crystallization seeds in combination with at least one modified component from the group of oxides of magnesium, zinc, cobalt, nickel, zirconium, hafnium, chromium and/or titanium. EP-B-0 373 765 describes – also in combination with α Fe_2O_3 seeds – yttrium and neodymium

compounds in addition to the oxides named above, as additional modifying components. The abrasive grains produced in accordance with the above-named methods have advantages for certain uses as compared to the state of the art.

Please replace paragraph [0009] with the following amended paragraph:

[0009]   Thus, in the case of abrasive grains produced via the sol/gel route, it was attempted in the past not only to increase the efficacy via the fineness of the crystal structure but also to obtain specific favorable properties for certain uses via dopings. EP-B-0 228 856 describes the addition of yttrium that is added – e.g. in the form of an yttrium salt with an easily volatile anion (nitrate, acetate, et al.) - to the α aluminum monohydrate during the sol/gel process and that reacts with the aluminum oxide to yield yttrium aluminum garnet ($3Y_2O_3 - 5Al_2O_3$). This material shows special advantages in the processing of stainless steel, titanium, nickel alloys, Aaluminum and other, hard-to chip alloys, but also with ordinary construction steel. Obviously, the imbedding of garnet crystals provide the abrasive grain with a particular wear resistance for those applications, which is then reflected in a high abrasion output. In addition to the Y_2O_3 or, respectively, its raw materials, the addition of crystallization seeds and/or other sintering additives is described. In EP-B-0 293 164, the addition of rare earths from the praseodymium, samarium, ytterbium, neodymium, lanthanum, gadolinium, cerium, dysprosium, erbium group and/or combinations of several members from this group is described as well. In this process, the rare earths form hexagonal aluminates with Al_2O_3 which, as imbeddings in the Al_2O_3 matrix, obviously increase the wear resistance of the abrasive grain even more. EP-B-0 368 837 describes abrasive grains whose toughness is increased through the formation of whisker-like crystals that are obtained through the addition of cerium compounds. The sol/gel methods also yields composites that are described in DE-A-196 07 709 and that differ from the aforementioned compounds in that in addition to the Al_2O_3 matrix at least two additional discontinuous structural components are present that differ from each other in the mean particle size by at least a factor of 10. In EP-B-0 4 91 184, composites on the basis of Al_2O_3 are described that feature imbeddings of isometric hard substances that are larger by at least a factor of 10 than the primary crystals that the matrix is constructed of.

Please replace paragraph [00017] with the following amended paragraph:

[00017]   While the places in the literature quoted above mostly refer to composites with SiC portions of > 2 mol %, the mechanical properties of hot-pressed Al_2O_3/SiC composites with low portions of SiC are listed in an article by authors Wilhelm and Wruss in the cfi/Ber. DGK 75, 40 – 44 (1998). In addition to the places in the literature quoted above, the Al_2O_3/SiC nanocomposites have been described in numerous other publications that have been largely summarized in an overview by Sternizke in the *Journal of the European Ceramic Society 17 (1997) 1061 – 1082*. In that article the suspicion is vented-, too, that Al_2O_3/SiC nanocomposites could close the gap between conventional abrasive agents and super abrasives. In contrast to this presumption, however, almost all publications mentioned in that article and the material properties quoted therefrom expressly refer to the use as a structural ceramic. Thus, e.g., the microstructures, thermodynamic stability, density, hardness, breaking strength, fracture toughness, the wear behavior and the creep rate are all mentioned. All those values are certain to play a role in the grinding process as well, however without allowing, by themselves, a valid statement about the suitability of any material as an abrasive grain. For example, great hardness is certainly a basic requirement for a material to be used as an abrasive grain. However, as the example of B_4C shows ~~that~~ it is often quoted in expert circles and ~~that~~ has never found widespread use as an abrasive grain in spite of its great hardness due to its insufficient chemical and thermal constancy and its high brittleness¬ a sum of properties must be considered in order to recognize the suitability as an abrasive agent. Other hard substances that range in their hardness values between conventional abrasives and super abrasives also could not succeed as abrasive grains because they lack additional properties such as toughness, thermal and chemical stability or other prerequisites important for the grinding process. Thus, the nanocomposite materials described in the literature that may have certain properties required for the grinding process, so far have not been able to be successfully used as abrasive grains. They rather behave similarly to those cutting ceramics on Al_2O_3 basis that have been used with great success e.g. in milling or lathing but that – processed for graining – in grinding show only an unsatisfactory abrasion performance that lies on the level of conventional melting corundums or even below that.

Please replace paragraphs [00034]-[00035] with the following amended paragraphs:

[00034]   Surprisingly, for Al_2O_3/~~Sie~~SiC nanocomposites with SiC portions under 5 mol % that were produced via a direct sol/gel route with the addition of crystallization seeds, performance factors were found in accordance with the method described above that are clearly above the performance factors found thus far in the case of Al_2O_3/~~Sie~~SiC nanocomposites. The performance factors of the nanocomposites according the invention are also above the values of the known pure or doped sol/gel corundums and thus between the conventional abrasive grains and the super abrasives in the target area.

[00035]   In contrast with the known Al_2O_3/SiC nanocomposites that are produced by blending the basic substances and subsequent condensing (e.g. through hot pressing, pressure-less sintering or hot isostatic pressing) and sintering, the production of the abrasive grains according to the invention proceeds in hydrochemical fashion via a direct sol/gel route with the use of crystallization seeds. Xu, Nakahira and Niihara describe in their article in the *Journal of the Ceramic Society of Japan, 1994, 102, 312 – 315* the use of the sol/gel technology in the production of Al_2O_3/SiC nanocomposites. However, they use the technology only in order to achieve the most homogeneous possible blend of the nano powders via an upstream colloidal solution of the particles. The sol is subsequently processed, through drying and calcination, into a homogeneous blend of ultra fine Al_2O_3 and ~~Sie~~SiC powders that are then hot-pressed – in analogy with conventional powder technology – under nitrogen at a pressure of 30 MPa and a temperature of 1,600 °C.

Please replace paragraphs [00039]-[00040] with the following amended paragraphs:

[00039]   Preferably, the Al_2O_3 sol is treated with an aqueous suspension of super-finely ground α-Al_2O_3 particles prior to the addition of SiC. The maximum particle size of the α Al_2O_3 particles that serve as crystallization seeds is below 1 μm, preferably below 0.2 μm. The amount of seed material to be used depends on the particle size and lies between 0.5 and 10 weight % relative to the Al_2O_3 contents of the end product. Since it depends on the number of seeds, in

addition to the fineness, even very small weight amounts of superfine seeds will suffice to promote the sintering process.

[00040]   The prepared suspension is then heated to the boiling point and expediently gelled through the addition of acid. Here, too, it is possible again to apply as an alternative any other type of gelling (aging, addition of electrolyte, temperature increase, concentration of the suspension, at et al.). Drying of the gel (after cooling off) is carried out within a temperature range between 50 °C and 120 °C. Subsequently, calcination occurs in a temperature range between 500 °C and 800 °C in order to evaporate the residual water and the acid. After calcination, the composites are present as green bodies with diameters of up to several millimeters, and are then sintered. The advantage of direct compression lies particularly in the high sintering activity of the dried and calcinated green bodies in which the original materials are already bound to each other chemically, with the compression and solidification to the finished composite thus proceeding considerably more effectively and favorably.

Please replace paragraph [00048] with the following amended paragraph:

[00048]   By way of the examples in Table 4 it can be seen that the product improvement through the imbedding of SiC particles is limited not only to SiC nanopowder, but also that outstanding abrasive performances can be achieved with grains that show relatively coarse SiC embeddings. However, it is clear that abrasive performance is the better for the finer SiC powders. Initially, for commercial reasons and for reasons of availability, in the production of the abrasive grain according to the invention, the powders listed in the examples that were obtained through extremely fine grinding of industrial SiC produced via the Acheson method were used exclusively. However, one may assume that the abovementioned trend will continue when even finer powders are being used.

Please replace paragraph [00051] with the following amended paragraph:

[00051] Therefore, the invention creates a nanocomposite abrasive grain on Al_2O_3 basis with predominantly intragranularly imbedded SiC nanoparticles that shows a hardness ($HV_{0.2}$) of greater [than] than 18 GPa, whose density is above 95% of the theoretical density, and that has a performance factor LF_{25} * of > 75% (* = measured as the mean value of 20 individual measurings on the material 100Cr6 (HRc = 62) with a cutting speed of 30 m/s, a feed motion of 20 μm, a work-piece speed of 0.5 mm/s, and with the use of a 3% emulsion as coolant).

Please replace paragraph [00058] with the following amended paragraph:

[00058] Suspension B is added to the Boehmite/sol suspension (Suspension A) while stirring, and the pH value of the mixture is adjusted to 1.8 with the aid of nitric acid. Subsequently, the mixture is heated to 95 °C, stirring constantly, and gelling is initiated by adding additional nitric acid drop by drop. After cooling off, the gel is dried at 85 °C in the drying chamber. The dried gel is pre-crushed to a particle size of less than 5 mm and then calcined calcinated at approximately 500 °C.

Please replace paragraph [00063] with the following amended paragraph:

[00063] The pH value of the mixture is adjusted to 1.8 with the aid of nitric acid. Subsequently, the mixture is heated to 95 °C, stirring constantly, and gelling is initiated by adding additional nitric acid drop by drop. After cooling off, the gel is dried at 85 °C in the drying chamber. The dried gel is pre-crushed to a particle size of less than 5 mm and then calcined calcinated at approximately 500 °C.

Please replace paragraph [00080] with the following amended paragraph:

[00080]   Table 4: Examples 4, ~~15   18~~ <u>14-17</u>

Example	SiC	Mean Particle Size d50	Hardness (HV0.2)	LF25 (%)
4	UF45	300 nm	19.7 GPa	85
14	UF25	500 nm	22.4 GPa	82
15	UF15	600 nm	23.1 GPa	77
16	P1000	18 μm	21.6 GPa	73
17	P600	26 μm	23.3 GPa	58